

Original Contribution

The Relation Between Body Size Perception and Change in Body Mass Index Over 13 Years

The Coronary Artery Risk Development in Young Adults (CARDIA) Study

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The authors assessed associations of body size perception and weight change over 13 years in black men and women and white men and women from the Coronary Artery Risk Development in Young Adults (CARDIA) Study (1992–2005). The perceptions of self and ideal body size were measured by using the Stunkard 9-figure scale at the year 7 examination (1992–1993). Figures were classified into underweight, normal weight, overweight, and obese. Self-ideal discrepancy yielded 4 body size satisfaction categories. Body mass index (BMI) (measured at years 7, 10, 15, and 20) was the dependent variable in gender-specific adjusted multiple regression models stratified by year 7 BMI. Obese women who perceived themselves as obese lost 0.09 BMI units annually, while those who perceived themselves as normal weight gained 0.31 units annually ($P = 0.0005$); obese women who considered their body size much too large had less annual weight gain than did those who considered their body size a bit too large (0.21 vs. 0.38 BMI units; $P = 0.009$). Obese women with overweight ideal body size gained less weight annually than did those with normal weight ideal body size (0.12 vs. 0.27 BMI units; $P = 0.04$). Results for men showed fewer and weaker associations. When obese women perceive themselves as obese and feel that their body size is too large, they gain less weight over time.

body image; body mass index; health status disparities; obesity; psychology; weight gain

Abbreviations: BMI, body mass index; CARDIA, Coronary Artery Risk Development in Young Adults.

Previous research suggests that disparities in obesity prevalence between African Americans and whites may be causally related to differences in body size perception. African Americans are less likely than whites to feel that they are overweight (1–3), are more satisfied with larger body sizes (4–10), and have a larger ideal body size than do whites (11–14). Dissatisfaction with body size is correlated with weight loss attempts (4–8), suggesting that African Americans' relative satisfaction with large body sizes may result in fewer weight loss attempts. Researchers have argued that African Americans may have a higher prevalence of obesity than do whites in part because they are more satisfied with larger body sizes and therefore less motivated to lose weight.

The theory that the black-white obesity disparity is due to cultural differences in body size perception depends upon the untested assumption that body size perception predicts weight change over time. The current study examines that assumption by assessing the longitudinal relation between body size perception (perceived size of self, ideal body size, and body size satisfaction) and average annual weight change over a 13-year follow-up period in a community dwelling sample of blacks and whites across a range of socioeconomic status. The current study tests the hypothesis that underestimation of body size, larger ideal body size, and higher levels of body size satisfaction are related to greater weight gain over time. We tested these relations in

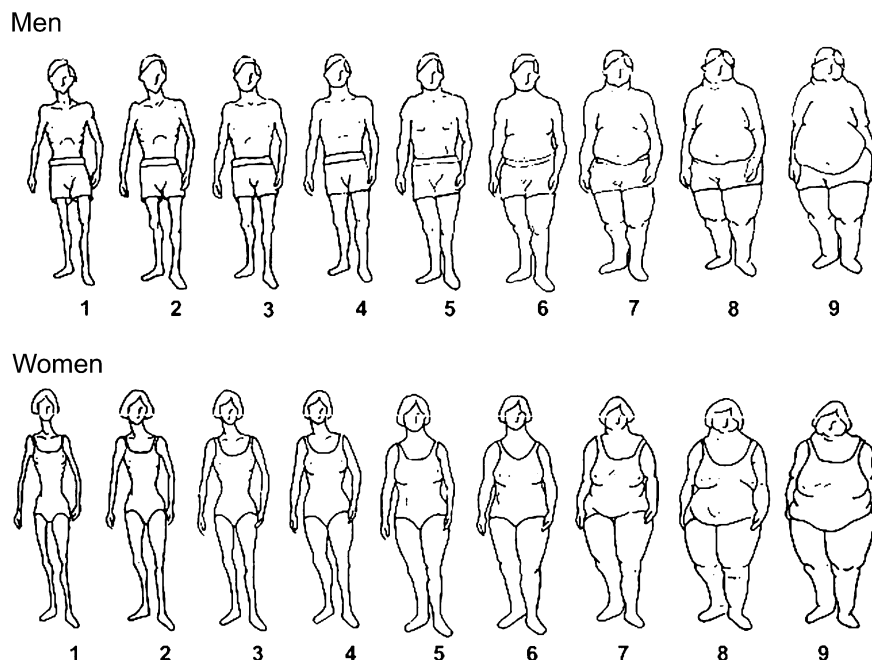


Figure 1. The 9-figure body size scale of Stunkard et al. (16). Reprinted with permission from *The Genetics of Neurological and Psychiatric Disorders* (16). Copyright 1983, Raven Press.

sex-specific analyses stratified by body mass index (BMI) (normal weight, overweight, and obese).

MATERIALS AND METHODS

Study population

The Coronary Artery Risk Development in Young Adults (CARDIA) Study is a multicenter, longitudinal study of the evolution of cardiovascular disease risk factors in black adults and white adults aged 18–30 years when recruited in 1985–1986 from 4 US cities: Birmingham, Alabama; Chicago, Illinois; Minneapolis, Minnesota; and Oakland, California (15). The CARDIA Study sample of 5,115 participants at baseline was designed to include approximately equal numbers of participants by race (black/white), sex, age (18–24/25–30 years), and education (high school or less/post-high school). Data from the following examinations were used in the current study: year 7 (1992–1993), year 10 (1995–1996), year 15 (2000–2001), and year 20 (2005–2006).

Exclusions

Of the 3,826 nonpregnant participants who attended at least 1 follow-up examination, participants were excluded ($n = 161$) from the current analysis if they had missing values on the body size judgment variables or BMI measurements or had a BMI of $<18.5 \text{ kg/m}^2$. A total of 3,665 participants were included.

Measurements

Three body size perception variables were used in the current study: self body size, ideal body size, and body size satisfaction. Self and ideal body sizes were assessed at the year 7 examination by using the Stunkard figure rating scale (Figure 1). The Stunkard scale consists of 9 silhouette figures that increase gradually in size from very thin (a value of 1) to very obese (a value of 9) (16). Following other investigators, we classify these figures into underweight (figures 1 and 2), normal weight (figures 3 and 4), overweight (figures 5 through 7), and obese (figures 8 and 9) (17). *Self body size* is the number of the figure selected by participants in response to the prompt: “Choose the figure that reflects how you think you look.” *Ideal body size* is the number of the figure chosen in response to the prompt: “Choose your ideal figure.” This scale has good validity and test-retest reliability (10, 18). For self body size and ideal body size, dummy variables were created for the underweight, normal weight, overweight, and obese body size categories.

The third body size perception variable used in the study, *body size satisfaction*, was defined as the difference between one’s perceived self body size and perceived ideal body size. A body size satisfaction variable was created for each participant by subtracting the number of the figure selected as the ideal body size from the number of the figure selected as the self body size. Four dummy variables were created for body size satisfaction based on the difference between self body size and ideal body size: *too small* (self – ideal < 1), *satisfied* (self = ideal), *a bit too large* (self – ideal = 1), and *much too large* (self – ideal > 1).

Table 1. Baseline (Year 7 Examination) Characteristics of Study Sample of Study Participants by Race/Sex Group, Stratified by Weight Category at Year 7, the CARDIA Study, 1992–2005^a

	Women		Men	
	Blacks	Whites	Blacks	Whites
Normal weight (BMI, 18.5–<25)				
No.	357	617	280	418
Mean age at year 7 examination, years	31.2	32.5****	31.0	32.3****
Highest education at year 20 examination, years	15.1	16.5****	13.8	16.2****
Mean no. of pregnancies at year 20	3.3	2.9*		
Smoked between year 7 and year 20, %	35	22****	51	28****
Mean BMI at year 7, kg/m ²	22.3	21.8****	22.6	22.9*
Mean BMI change from year 7 to year 20, kg/m ²	3.8	2.3****	2.5	2.6
Overweight (BMI, 25–<30)				
No.	254	205	270	390
Mean age at year 7 examination, years	32	32.9**	31.8	32.8***
Highest education at year 20 examination, years	14.7	15.8****	14.4	16.1****
Mean no. of pregnancies at year 20	3.4	2.8**		
Smoked between year 7 and year 20, %	33	31	34	27*
Mean BMI at year 7, kg/m ²	27.4	27**	27.2	27
Mean BMI change from year 7 to year 20, kg/m ²	4.1	3.9	2.6	2.5
Obese (BMI, ≥30)				
No.	396	164	181	133
Mean age at year 7 examination, years	31.9	32.8*	31.6	32.5*
Highest education at year 20 examination, years	14.3	15.2****	14.2	15.6****
Mean no. of pregnancies at year 20	3.3	3.0		
Smoked between year 7 and year 20, %	33	37	35	21**
Mean BMI at year 7, kg/m ²	36.8	36	34.5	33.7
Mean BMI change from year 7 to year 20, kg/m ²	3.3	2.8	3.2	2.1

Abbreviations: CARDIA, Coronary Artery Risk Development in Young Adults; BMI, body mass index.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; **** $P < 0.0001$.^a Means were adjusted for race, number of pregnancies, age at year 7 examination, highest level of education, and cigarette smoking. Race differences (within gender) in continuous variables were tested by using the *t* test, and categorical variables were tested by using the chi-square.

Height and weight were measured for participants wearing no shoes and light clothing. Body mass index was calculated as the weight (kg)/standing height (m)² ratio. Age, race, years of education, sex, smoking status, and number of pregnancies (for women) were assessed using self-report. A dichotomous smoking variable was created for each examination year, wherein participants were given a “1” if they were current smokers and a “0” otherwise.

Statistical analyses

Participants' characteristics at our baseline (the year 7 examination) and change in BMI between our baseline and our final measurement point (year 20) were calculated by race/sex group. We tested for ethnic differences within each sex group using the *t* test for continuous variables and the chi-squared test for categorical variables.

Generalized estimating equations were used to model the effect of body size perception variables on the rate of change in BMI over the 13-year period of our study. Generalized

estimating equations were used to account for within-person correlations across repeated measurements. We examined the relation between each body size perception variable and change in BMI (measured as a continuous variable), stratified by 3 categories of year 7 BMI: normal weight (BMI, 18.5–<25), overweight (BMI, 25–<30), and obese (BMI, ≥30). Separate sex-specific generalized estimating equation models were run on each BMI group for each set of body size perception (dummy) variables (self, ideal, and satisfaction). Normal weight body size perception (selection of figures 3 or 4) served as the reference group in models assessing self and ideal body size perception. For models assessing the influence of body size satisfaction, *a bit too large* (self – ideal = 1) served as the reference group because it was the modal response across BMI groups.

Time-independent covariates were race (1 = black, 0 = white), year 7 age, maximum years of education, body size perception dummy variables, and, for women, total number of pregnancies through the year 20 examination. The coefficients of these main effects reflect the effect on baseline

Table 2. Adjusted Estimated Mean Annual Body Mass Index Change for Each Body Size Perception Variable Among Women, by Race/Sex Group, Stratified by Weight Category at the Year 7 Examination, the CARDIA Study, 1992–2005

Figure Size	Total ^a		Black		White	
	Annual BMI Change	No.	Annual BMI Change	No.	Annual BMI Change	No.
Normal Weight (BMI, 18.5–<25)						
Perceived size of self						
Underweight ^b	0.23	132	0.29	78	0.13	54
Normal weight ^c (reference group)	0.22	690	0.32	237	0.17	453
Overweight ^d	0.22	152	0.24	42	0.22	110
Obese ^e		0		0		0
Ideal body size						
Underweight ^b	0.20	194	0.29	68	0.15	126
Normal weight ^c (reference group)	0.23	775	0.31	284	0.18	491
Overweight ^d		5		5		0
Obese ^e		0		0		0
Body size satisfaction						
Too small (self – ideal < 0)	0.24	117	0.29	80	0.14	37
Satisfied (self – ideal = 0)	0.21	250	0.29	118	0.13*	132
A bit too large (self – ideal = 1) (reference group)	0.22	459	0.32	124	0.18	335
Much too large (self – ideal > 1)	0.24	148	0.28	35	0.22	113
Overweight (BMI, 25–<30)						
Perceived size of self						
Underweight ^b		6		6		0
Normal weight ^c (reference group)	0.28	131	0.29	90	0.22	41
Overweight ^d	0.31	321	0.33	157	0.30	164
Obese ^e		1		0		0
Ideal body size						
Underweight ^b	0.35	41		28		13
Normal weight ^c (reference group)	0.31	404	0.32	215	0.29	189
Overweight ^d		14		11		3
Obese ^e		0		0		0

Table continues

(year 7) BMI of a unit difference in each of the variables. A dichotomous variable for current cigarette smoking was included as a time-dependent covariate. We also included the time since baseline (the year 7 examination), in years, as a predictor. The coefficient for the main effect of time represents the change in BMI for each year of study time since baseline (the year 7 examination). To test the hypothesis that body size perception is related to the rate of BMI change, each model included an interaction term for each body size perception variable and time. If the beta coefficient for the interaction of time and the body size perception variable is statistically significant, this suggests that the rate of BMI change is dependent on body size perception. Body size perception dummy variables that were selected by less than 30 participants were not included in analyses. Additional models including income and site as time-independent variables were estimated. Results were virtually the same and are not shown.

In a separate set of models, we included an interaction term for race \times body size perception \times time to test whether the relation between body size perception and the rate of BMI change varied by race. We also ran separate models for blacks and whites, using the same covariates as described above with the exception of race. The mean annual estimated BMI change for each body size perception variable was calculated by using the above models. Estimated beta coefficients (reported below) reflect the mean difference in annual BMI change between individuals who selected the reference group dummy variable and those who selected the comparison dummy variable.

RESULTS

Table 1 shows characteristics of participants (and mean BMI change over time) at the year 7 CARDIA Study

Table 2. Continued

Figure Size	Total ^a		Black		White	
	Annual BMI Change	No.	Annual BMI Change	No.	Annual BMI Change	No.
Body size satisfaction						
Too small (self – ideal < 0)		6		6		0
Satisfied (self – ideal = 0)	0.33	42	0.36	37		5
A bit too large (self – ideal = 1) (reference group)	0.30	196	0.31	114	0.28	82
Much too large (self – ideal > 1)	0.31	215	0.33	97	0.30	118
Obese (BMI, ≥30)						
Perceived size of self						
Underweight ^b		0		0		0
Normal weight ^c (reference group)	0.31	30		27		3
Overweight ^d	0.28	465	0.29	326	0.28	139
Obese ^e	–0.09***	65	–0.09**	43		22
Ideal body size						
Underweight ^b		14		13		1
Normal weight ^c (reference group)	0.27	438	0.28	293	0.26	145
Overweight ^d	0.12*	103	0.17	85		18
Obese ^e		5		5		0
Body size satisfaction						
Too small (self – ideal < 0)		10		10		
Satisfied (self – ideal = 0)	0.26	37	0.27	36		1
A bit too large (self – ideal = 1) (reference group)	0.38	96	0.39	78		18
Much too large (self – ideal > 1)	0.21**	417	0.21*	272	0.21	145

Abbreviations: CARDIA, Coronary Artery Risk Development in Young Adults; BMI, body mass index.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$ (significance indicates difference from reference group).

^a Adjusted for number of pregnancies, age, highest level of education, and cigarette smoking. Models including both races were also adjusted for race. Models were not performed on cells with insufficient sample size ($n < 30$).

^b Underweight (figures 1 and 2 on the body size scale of Stunkard et al. (16)).

^c Normal weight (figures 3 and 4 on the body size scale of Stunkard et al. (16)).

^d Overweight (figures 5–7 on the body size scale of Stunkard et al. (16)).

^e Obese (figures 8 and 9 on the body size scale of Stunkard et al. (16)).

examination by sex, race, and BMI group. For all BMI groups and both genders, blacks were younger than whites and had fewer years of education than did whites. Among men at every BMI group and normal weight women, blacks were more likely than whites to have smoked at some point during the study period. Among normal weight and overweight women, blacks had more pregnancies than whites did, and blacks had higher BMI than whites did. Normal weight black men had a slightly higher BMI than did normal weight white men. Finally, normal weight white women showed less increase in BMI over the 13-year study period than did normal weight black women.

Tables 2 and 3 show the mean BMI change for each level of body size perception for each BMI group, adjusted for age, maximum years of education, smoking, and number of pregnancies (for women). In models that included participants across races, a dummy variable was used to adjust for race (black = 1). Also shown in the tables is the number of observations for each body size perception variable, as well

as the mean values by race for each sex/BMI group. Normal weight white women who were satisfied with their body size had a lower annual BMI change than did normal weight white women who perceived that they were a bit too large ($\beta = -0.04$, $P = 0.03$) (Table 2). Moreover, obese women who perceived their body size to be obese actually lost weight over the study period ($\beta = 0.40$, $P = 0.0005$); the same pattern was evident in black women in race-specific models ($\beta = -0.39$, $P = 0.003$). Obese women who selected an overweight figure as an ideal body size gained less weight than did obese women who selected a normal weight ideal body size ($\beta = -0.15$, $P = 0.04$). Obese women who perceived their body size as being much too large gained less weight than did obese women who perceived their body size as only a bit too large ($\beta = -0.17$, $P = 0.009$). This pattern was also found among obese black women ($\beta = -0.18$, $P = 0.01$). Among men (Table 3), normal weight men who felt that their body size was either much too large or too small gained more weight annually than did

Table 3. Adjusted Estimated Mean Annual Body Mass Index Change for Each Body Size Perception Variable Among Men, by Race/Sex Group, Stratified by Weight Category at the Year 7 Examination, the CARDIA Study, 1992–2005

	Total ^a		Black		White	
	Annual BMI Change	No.	Annual BMI Change	No.	Annual BMI Change	No.
Normal Weight (BMI, 18.5–<25)						
Perceived size of self						
Underweight ^b	0.18	132	0.19	67	0.17	65
Normal weight ^c (reference group)	0.20	393	0.20	172	0.20	221
Overweight ^d	0.18	173	0.13	41	0.20	132
Obese ^e		0		0		0
Ideal body size						
Underweight ^b	0.14	32		19		13
Normal weight ^c (reference group)	0.20	532	0.20	189	0.20	343
Overweight ^d	0.20	133	0.19	71	0.23	62
Obese ^e		1		1		0
Body size satisfaction						
Too small (self – ideal < 0)	0.20*	295	0.22	139	0.18	158
Satisfied (self – ideal = 0)	0.22	192	0.20*	99	0.26	93
A bit too large (self – ideal = 1) (reference group)	0.15	147	0.11	32	0.16	115
Much too large (self – ideal > 1)	0.22*	62		10	0.21	52
Overweight (BMI, 25–<30)						
Perceived size of self						
Underweight ^b		8		7		1
Normal weight ^c (reference group)	0.19	140	0.23	81	0.15	59
Overweight ^d	0.19	511	0.18	181	0.19	330
Obese ^e		1		1		0
Ideal body size						
Underweight ^b		24		14		10
Normal weight ^c (reference group)	0.20	469	0.21	178	0.20	291
Overweight ^d	0.16	166	0.14	77	0.17	89
Obese ^e		1		1		0

Table continues

normal weight men who felt that their bodies were a bit too large ($\hat{\beta} = 0.07$, $P < 0.05$).

Among normal weight women, there was an interaction between race (black = 1) and time for all body size perception models (for self-perception: $\hat{\beta} = 0.15$, $P < 0.0001$; for ideal: $\hat{\beta} = 0.13$, $P < 0.0001$; and for body size satisfaction: $\hat{\beta} = 0.15$, $P < 0.0001$), indicating that black women gained more weight over time than did white women. Among normal weight women, there was also a significant race \times time \times overweight self-perception interaction ($\hat{\beta} = -0.12$, $P < 0.05$), reflecting that, relative to same-race women who perceived themselves as normal weight, white women who perceived themselves as overweight gained slightly more and black women who perceived themselves as overweight gained less. There were no significant race interactions for overweight women, and race interaction models were not

run for obese women because of insufficient numbers of white women for some variables.

Among overweight men, there was a race \times time interaction for self body size perception ($\hat{\beta} = 0.07$, $P < 0.05$), indicating that white men who perceived themselves as normal weight gained less than did black men who perceived themselves as normal weight. There was also a race \times time \times overweight self-perception interaction among overweight men ($\hat{\beta} = -0.09$, $P < 0.05$). This reflects that, relative to those who perceived themselves as normal weight, overweight white men who perceived themselves as overweight gained more and overweight black men who perceived themselves as overweight gained less. Finally, there was a race \times time interaction among obese men in the model for ideal body size perception ($\hat{\beta} = 0.12$, $P < 0.05$), which reflects that white men who selected a normal weight figure

Table 3. Continued

	Total ^a		Black		White	
	Annual BMI Change	No.	Annual BMI Change	No.	Annual BMI Change	No.
Body size satisfaction						
Too small (self – ideal < 0)		25		19		9
Satisfied (self – ideal = 0)	0.18	128	0.19	86	0.15	42
A bit too large (self – ideal = 1) (reference group)	0.19	278	0.18	91	0.19	187
Much too large (self – ideal > 1)	0.21	226	0.23	74	0.20	152
Obese (BMI, ≥30)						
Perceived size of self						
Underweight ^b		1		1		0
Normal weight ^c (reference group)		14		13		1
Overweight ^d	0.22	272	0.25	154	0.17	118
Obese ^e		27		13		14
Ideal body size						
Underweight ^b		10		8		2
Normal weight ^c (reference group)	0.23	151	0.29	84	0.16	67
Overweight ^d	0.20	151	0.22	88	0.17	63
Obese ^e		2		1		1
Body size satisfaction						
Too small (self – ideal < 0)		6		5		1
Satisfied (self – ideal = 0)	0.19	33		27		6
A bit too large (self – ideal = 1) (reference group)	0.20	87	0.23	55	0.15	32
Much too large (self – ideal > 1)	0.23	188	0.30	94	0.17	94

Abbreviations: CARDIA, Coronary Artery Risk Development in Young Adults; BMI, body mass index.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$ (significance indicates difference from reference group).

^a Adjusted for age at year 7, highest level of education, and cigarette smoking. Models including both races were also adjusted for race. Models were not performed on cells with insufficient sample size ($n < 30$).

^b Underweight (figures 1 and 2 on the body size scale of Stunkard et al. (16)).

^c Normal weight (figures 3 and 4 on the body size scale of Stunkard et al. (16)).

^d Overweight (figures 5–7 on the body size scale of Stunkard et al. (16)).

^e Obese (figures 8 and 9 on the body size scale of Stunkard et al. (16)).

for their ideal body size gained less than did black men who selected a normal weight ideal body size.

DISCUSSION

In this biracial cohort of community-dwelling adults aged 25–37 years at baseline, we found that the relations between body size perception and subsequent weight gain over 13 years varied by objectively measured body size at baseline. Our findings among obese women were consistent with the hypothesis that body size perception is related to weight change. Specifically, obese women who perceived themselves as obese lost weight, while obese women who perceived themselves as being normal or overweight gained weight. In addition, obese women who perceived their body size as much too large gained less weight than did obese women who were more satisfied with their body size. We did not observe these patterns in nonobese women or in men.

There was no support for the hypothesis that larger ideal body size results in increased weight gain. To the contrary, obese women whose ideal body size was overweight actually gained *less* weight than did obese women who selected a normal weight ideal body size. One possible explanation is that more realistic body size goals are associated with less weight gain. Best practice in clinical weight management counseling recommends that obese patients choose a realistic goal weight that they can maintain over time (19). Choosing an unrealistically slim goal yields disappointment and lowers motivation when the weight cannot be attained or maintained.

Findings among normal weight white women and normal weight men contradicted the hypothesis that higher body size satisfaction is related to increased weight gain. Normal weight white women who were satisfied with their body size gained *less* weight than did comparable women who perceived themselves as slightly too large. For normal weight

black women, these associations were absent. Similarly, normal weight men who perceived their body size as slightly too large gained less weight over time than did those who perceived themselves as much too large or too small. These findings suggest that, for normal weight white women and men, greater satisfaction with body size results in better weight control. Among normal weight individuals, feeling dissatisfied may suggest excessive weight concern indicative of an eating disorder. For example, treatment to decrease excessive weight concern predicts weight control after smoking cessation (20). It should be mentioned that our observed relation between body size satisfaction and weight change in normal weight men is nonlinear. Those who were satisfied with their body size gained more weight than did those who perceived their body size to be a bit too large, although this difference was not statistically significant.

The influence of self-image on weight gain goes in opposite directions for normal weight black versus white women, as evidenced by a significant race interaction. Among normal weight women, white women who perceive themselves as overweight gain more than those who perceive themselves as normal weight, while black women who perceive themselves as overweight gain less than those who perceive themselves as normal weight. A similar interaction was significant among overweight men: Among overweight men, black men who perceived themselves to be overweight gained less than those who perceived themselves to be normal weight, while in white men the direction was reversed. The same pattern was shown among normal weight black men but not normal weight white men. It is not clear why perception of oneself as overweight would have different effects on blacks and whites. One possibility is that, because of less cultural emphasis on thinness among blacks than whites, self-perception as overweight leads to more weight-related anxiety among whites than blacks. Weight-related anxiety may result in less self-efficacy and less ability to cope rationally with one's weight and, consequently, greater weight gain.

Overall, body size perception appears to be less influential on men than it is on women. One explanation for the general lack of a finding in men may be that men tend to indicate less dissatisfaction with their body size. Lynch et al. (21) found that 88% of the men who completed body size perception measures at the year 7 CARDIA Study examination either were satisfied with their current body size or wanted to be larger. A number of other studies have found that men at all weights express less body size dissatisfaction than do women (22–24). It is likely that body size perception is unrelated to weight change in men because men attach less importance to body size.

Why was the relation between self body size perception and weight change evident only in obese women? We think it is because only obese women tended to see themselves as much larger than “average.” Only obese women tended to select self body sizes above the midpoint of the figure rating scale (67% of obese women compared with 15% of overweight and <1% of normal weight women). Only the obese women who perceived themselves to be at the largest end of the body-size continuum showed evidence of weight loss.

Perceiving oneself as approximately average or less than average in body size (as selection of the scale midpoint suggests) may not trigger the motivation necessary to control or lose weight.

If perception that one's body size is at the large end of the body size continuum triggers weight control behavior, this may explain why obesity follows social ties. Recent research suggests that obesity is “socially contagious”; that is, individuals with more obese people in their social networks or neighborhoods are more likely to become obese themselves (25, 26). It is possible that this effect is mediated by shifts in what is considered a normal body size. When close friends or family become obese, large body sizes may appear to be relatively normal (i.e., less extreme and/or closer to the average body size), and motivation to control one's own body size may decrease. In certain circumstances, obesity may become a social norm, leading obese women to be more accepting of their size and less likely to lose or maintain weight.

Strengths and limitations

The main strength of the current study is the longitudinal nature of the design, which allowed us to test the temporal relation between body image and weight change. Another strength is that we were able to control for measured baseline (year 7) BMI. Because body size perception is highly influenced by actual BMI, it is important to control for measured BMI when assessing the effect of body perception variables (21).

An additional strength of the study is that the CARDIA Study sample has a large number of blacks and whites of both genders who represent a wide range of socioeconomic status. Consequently, we were able to include and control for many potential covariates of weight change, including race, number of pregnancies, smoking status, and years of education.

A limitation of the study is that the Stunkard scale used in this study may not be sensitive enough to pick up subtle but meaningful differences in body size perception. Participants do not use the full range of the scale; even participants with the highest BMIs rarely selected the largest figures on the scale. Additionally, the Stunkard scale has been validated only on whites, so it is unknown whether it is also valid among African Americans. Furthermore, as with all observational studies, the possibility of residual confounding cannot be ruled out.

Another limitation is that body size perception was measured only at baseline, while weight was assessed over a 13-year period. If body size perception changes significantly over time, current estimates of the relation between body size perception and weight change may be incorrect.

Finally, some of the cells for our analyses were small in size and precluded, for example, our studying the association between being very unsatisfied with one's weight and weight gain in obese white women. Similarly, some apparent associations in normal weight blacks could not be verified because of lack of statistical power. Clearly, additional research is needed to shed further light on these issues.

Implications

Overall, our study showed that the effect of body size dissatisfaction is dependent on baseline weight status. Dissatisfaction with body size is associated with weight loss in obese women but also with weight gain in men and white women of normal weight, while having no effect on overweight men and women and obese men. Among obese women, perception of one's body size as being obese may be a motivational trigger for implementing the behavioral changes required for weight control. If overweight women evaluate their body size relative to the body sizes of the general population, most of whom in the United States are overweight, they may see their weight as normal and less problematic, and they may consequently lack motivation to control their weight.

In conclusion, the current study suggests that body size dissatisfaction and perception of oneself as too large may facilitate weight control for obese women but have little impact on weight change for men and nonobese women. There is some evidence to suggest that normal weight white women and men may have better weight control if they are more satisfied with their body size. Of course, the difficult task of weight control always requires awareness of whether one's body size is too large. However, the current study suggests that the self-perception of being too large is insufficient by itself to predict, and presumably to motivate, weight control, with the exception of obese women who perceive themselves as being obese.

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REFERENCES

- Bennett GG, Wolin KY. Satisfied or unaware? Racial differences in perceived weight status [electronic article]. *Int J Behav Nutr Phys Act*. 2006;3:40.
- Kuchler F, Variyam JN. Mistakes were made: misperception as a barrier to reducing overweight. *Int J Obes Relat Metab Disord*. 2003;27(7):856–861.
- Paeratakul S, White MA, Williamson DA, et al. Sex, race/ethnicity, socioeconomic status, and BMI in relation to self-perception of overweight. *Obes Res*. 2002;10(5):345–350.
- Lee RE, Harris KJ, Catley D, et al. Factors associated with BMI, weight perceptions and trying to lose weight in African-American smokers. *J Natl Med Assoc*. 2005;97(1):53–61.
- Jaeger B, Ruggiero GM, Edlund B, et al. Body dissatisfaction and its interrelations with other risk factors for bulimia nervosa in 12 countries. *Psychother Psychosom*. 2002;71(1):54–61.
- Riley NM, Bild DE, Cooper L, et al. Relation of self-image to body size and weight loss attempts in black women: the CARDIA Study. Coronary Artery Risk Development in Young Adults. *Am J Epidemiol*. 1998;148(11):1062–1068.
- Wardle J, Haase AM, Steptoe A. Body image and weight control in young adults: international comparisons in university students from 22 countries. *Int J Obes (Lond)*. 2006;30(4):644–651.
- Anderson LA, Eyler AA, Galuska DA, et al. Relationship of satisfaction with body size and trying to lose weight in a national survey of overweight and obese women aged 40 and older, United States. *Prev Med*. 2002;35(4):390–396.
- Sánchez-Johnsen LA, Fitzgibbon ML, Martinovich Z, et al. Ethnic differences in correlates of obesity between Latin-American and black women. *Obes Res*. 2004;12(4):652–660.
- Smith DE, Thompson JK, Raczyński JM, et al. Body image among men and women in a biracial cohort: the CARDIA Study. *Int J Eat Disord*. 1999;25(1):71–82.
- Becker DM, Yanek LR, Koffman DM, et al. Body image preferences among urban African Americans and whites from low income communities. *Ethn Dis*. 1999;9(3):377–386.
- Flynn KJ, Fitzgibbon M. Body images and obesity risk among black females: a review of the literature. *Ann Behav Med*. 1998;20(1):13–24.
- Parnell K, Sargent R, Thompson SH, et al. Black and white adolescent females' perceptions of ideal body size. *J Sch Health*. 1996;66(3):112–118.
- Powell AD, Kahn AS. Racial differences in women's desires to be thin. *Int J Eat Disord*. 1995;17(2):191–195.
- Friedman GD, Cutter GR, Donahue RP, et al. CARDIA: study design, recruitment, and some characteristics of the examined subjects. *J Clin Epidemiol*. 1988;41(11):1105–1116.
- Stunkard AJ, Sorensen T, Schulsinger F. Use of the Danish Adoption Register for the study of obesity and thinness. In: Kety S, Rowland L, Sidman R, et al, eds. *The Genetics of Neurological and Psychiatric Disorders*. New York, NY: Raven Press; 1983:115–120.
- Bhuiyan AR, Gustat J, Srinivasan SR, et al. Differences in body shape representations among young adults from a biracial (Black-White), semirural community: the Bogalusa Heart Study. *Am J Epidemiol*. 2003;158(8):792–797.
- Thompson JK, Altabe MN. Psychometric qualities of the figure rating scale. *Int J Eat Disord*. 1991;10(5):615–619.
- Serdula MK, Khan LK, Dietz WH. Weight loss counseling revisited. *JAMA*. 2003;289(14):1747–1750.
- Levine MD, Marcus MD, Kalarchian MA, et al. Weight concerns affect motivation to remain abstinent from smoking postpartum. *Ann Behav Med*. 2006;32(2):147–153.
- Lynch E, Liu K, Spring B, et al. Association of ethnicity and socioeconomic status with judgments of body size: the Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Am J Epidemiol*. 2007;165(9):1055–1062.
- Grilo CM, Masheb RM. Correlates of body image dissatisfaction in treatment-seeking men and women with binge eating disorder. *Int J Eat Disord*. 2005;38(2):162–166.

23. Grilo CM, Masheb RM, Brody M, et al. Binge eating and self-esteem predict body image dissatisfaction among obese men and women seeking bariatric surgery. *Int J Eat Disord.* 2005; 37(4):347–351.
24. Pingitore R, Spring B, Garfield D. Gender differences in body satisfaction. *Obes Res.* 1997;5(5):402–409.
25. Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. *N Engl J Med.* 2007;357(4): 370–379.
26. Boardman JD, Saint Onge JM, Rogers RG, et al. Race differentials in obesity: the impact of place. *J Health Soc Behav.* 2005;46(3):229–243.